## *Picea rubens - (Abies fraseri) / Vaccinium erythrocarpum / Oxalis montana - Dryopteris campyloptera / Hylocomium splendens* Forest

| | |
|---|---|
| COMMON NAME | Red Spruce - (Fraser Fir) / Highbush Cranberry / Common Wood Sorrel - Mountain Woodfern / Stairstep Moss Forest |
| SYNONYM | Red Spruce - Fraser Fir Forest (Deciduous Shrub Type) |
| PHYSIOGNOMIC CLASS | Forest (I) |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest (I.A) |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest (I.A.8) |
| PHYSIOGNOMIC SUBGROUP | Natural/Semi-natural (I.A.8.N) |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c.) |
| ALLIANCE | *Abies fraseri - Picea rubens* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

***Globally***

This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee, western North Carolina, and southwestern Virginia.

***Great Smoky Mountains National Park***

This community was sampled on the Mount Le Conte quadrangle and is not found on the Cades Cove quadrangle. This forest was found on the steep slopes and ridges in the vicinity of Mount Kephart and on steep slopes south of the Mount Le Conte summit. It should be looked for at other locations in the Park from approximately 5500 to just over 6000 feet elevation. Above this elevation, forests are dominated by *Abies fraseri*.

ENVIRONMENTAL DESCRIPTION

***Globally***

This forest is best developed between 5500-6200 feet elevation (1680 and 1990 meters) but may occur at lower elevations and is found on all topographic positions. Soils are highly variable, from deep mineral soils to well-developed boulderfields, where a thin organic layer and moss mat overlie the rocks and there are pockets of mineral soil in deep crevices between boulders. The dominant soils are Inceptisols with scattered occurrences of Spodosols at the highest elevations (White *et al.* 1993). Generally, soils can be described as shallow and rocky, with well-developed organic and A horizons. All soils in these high elevation forests are low in base saturation, high in organic matter, and are acid in reaction (pH 3-5), with a high aluminum content. The moisture regimes of these areas are mesic to wet due to high rainfall, abundant cloud cover, fog deposition, and low temperatures. The climate has been classified as perhumid, with the temperature varying elevationally from mesothermal to microthermal. The regional geology is dominated by complexly folded metamorphic, sedimentary, and igneous rocks of the Precambrian and early Paleozoic age, including phyllites, slates, schists, sandstones, quartzites, granites, and gneisses.

***Great Smoky Mountains National Park***

This community was found on steep, middle to high slopes above 5500 feet to just over 6000 feet. Stands were affected by wind, ice, and Balsam Woolly Adelgid.

MOST ABUNDANT SPECIES

***Globally***

| Stratum | Species |
|---|---|
| Tree canopy | *Picea rubens, (Abies fraseri)* |
| Subcanopy | *Betula alleghaniensis*, *Sorbus americana*, *Acer spicatum*, *Amelanchier laevis* |
| Short Shrub | *Viburnum lantanoides*, *Vaccinium erythrocarpum* |
| Herbaceous | *Oxalis montana*, *Athyrium filix-femina* ssp. *asplenioides*, *Dryopteris campyloptera* |
| Nonvascular | *Hylocomium splendens*, *Ptilium crista-castrensis*, *Bazzania trilobata* |

***Great Smoky Mountains National Park***

| Stratum | Species |
|---|---|
| Tree canopy | *Picea rubens* |
| Shrub | *Abies fraseri, Picea rubens, Rubus canadensis, Vaccinium erythrocarpum* |
| Herbaceous | *Aster acuminatus, Athyrium filix-femina, Oxalis montana* |

CHARACTERISTIC SPECIES

***Globally***

*Picea rubens, Abies fraseri, Viburnum lantanoides*, *Vaccinium erythrocarpum, Oxalis montana, Hylocomium splendens, Bazzania trilobata*

***Great Smoky Mountains National Park***

*Picea rubens, Abies fraseri, Rubus allegheniensis, Clintonia borealis, Oxalis montana, Solidago glomerata, Vaccinium erythrocarpum*

VEGETATION DESCRIPTION

***Globally***

These forests are dominated by needle-leaved evergreen trees and have a characteristic understory of southern Appalachian endemic species and a conspicuous bryophyte layer. Canopies are dominated by *Picea rubens*, with or without *Abies fraseri,* sometimes with lesser amounts of *Betula alleghaniensis* and *Sorbus americana.* The subcanopy contains canopy species as well as *Acer spicatum* and *Amelanchier laevis*. The shrub strata are dominated by deciduous species and can be sparse to dense. Typical shrub species include *Viburnum lantanoides*, *Vaccinium erythrocarpum*, *Vaccinium simulatum*, *Sambucus racemosa* var. *pubens*, *Rubus allegheniensis*, *Ilex montana*, *Rhododendron catawbiense,* and *Rubus canadensis*. Extensive patches of *Abies fraseri* seedlings and standing dead stems of *Abies fraseri* are common. Herb density can be high but is inversely related to the density of the shrub layer. Common herbaceous species include *Oxalis montana*, *Athyrium filix-femina* ssp. *asplenioides*, *Dryopteris campyloptera*, and *Clintonia borealis.* Other herbs include *Aster acuminatus*, *Aster chlorolepis*, *Carex gynandra*, *Carex pensylvanica*, *Chelone lyonii*, *Circaea alpina* ssp. *alpina*, *Houstonia serpyllifolia, Huperzia lucidula*, *Maianthemum canadense*, *Rugelia nudicaulis*, *Solidago glomerata, Solidago glomerata*, *Streptopus roseus* var. *roseus*, and *Viola macloskeyi* ssp. *pallens*. Bryophytes and lichens make up a considerable percent of the vegetative coverage in this community, occurring on the surface of the soil, trees, and fallen logs. Characteristic non-vascular species include *Hylocomium splendens*, *Ptilium crista-castrensis*, *Leptodontium excelsum*, *Bazzania trilobata*, *Bazzania nudicaulis*, *Alectoria fallacina*, *Hypotrachyna virginica*, *Dicranum scoparium*, and *Dicranum fuscescens*.

***Great Smoky Mountains National Park***

These forests have canopies that are strongly dominated by *Picea rubens* and rather open due to *Abies fraseri* mortality. The shrub strata are dense and composed of a mix of deciduous shrubs and regenerating *Picea rubens* and *Abies fraseri*. Other shrub species include *Amelanchier laevis, Betula alleghaniensis, Diervilla sessilifolia, Menziesia pilosa, Prunus pensylvanica, Vaccinium erythrocarpum, Rubus allegheniensis, Sambucus racemosa* var. *pubens., Sorbus americana,* and *Viburnum lantanoides*. Standing dead trees are common, as is abundant coarse woody debris on the forest floor. The litter layer is thick, and bryophyte cover can be high, while herbaceous cover is sparse. Herbaceous species include *Aster acuminatus, Athyrium filix-femina, Clintonia borealis, Dennstaedtia punctilobula, Dryopteris campyloptera, Oxalis montana, Solidago glomerata*, and *Viola blanda.*

OTHER NOTEWORTHY SPECIES

Rare or regionally rare vascular plant species associated with this community include *Abies fraseri*, *Betula papyrifera* var. *cordifolia*, *Botrychium oneidense*, *Calamagrostis canadensis*, *Cardamine clematitis*, *Carex projecta*, *Carex ruthii*, *Chelone lyonii, Geum geniculatum*, *Glyceria nubigena*, *Phegopteris connectilis*, *Poa palustris*, *Prenanthes roanensis, Rugelia nudicaulis, Stachys clingmanii, Stellaria corei,* and *Streptopus amplexifolius*. Rare non-vascular plants include *Bazzania nudicaulis*, *Brachydontium trichodes*, *Gymnoderma lineare, Leptodontium excelsum*, *Metzgeria temperata*, *Nardia scalaris*, *Plagiochila corniculata*, and *Sphenolobopsis pearsonii*.

Animals endemic to high elevation areas of the southern Appalachians include Carolina Flying Squirrel *(Glaucomys sabrinus coloratus*), Yonahlossee Salamander *Plethodon yonahlossee*, Weller's Salamander (*Plethodon welleri*), Spruce-fir Moss Spider *Microhexura montivaga*. Rare animal species that are northern disjuncts include Black-capped Chickadee (*Parus atricapillus*, and Northern Saw-whet Owl (*Aegolius acadicus*). The spruce-fir moss spider (*Microhexura montivaga*) is specific to this community type. The spider populations seem to be decreasing with the decline of these forests. As the canopy thins, moss desiccation increases, thus affecting the spider's habitat.

This community provides breeding habitat for many migrant landbird species. Typical bird species that utilize this habitat include Canada Warbler (*Wilsonia canadensis*), Black-throated Blue Warbler (*Dendroica caerulescens*), Blackburnian Warbler (*Dendroica fusca*), Black-throated Green Warbler (*Dendroica virens*), Gray Catbird (*Dumetella carolinensis)*, Verry (*Catharus fuscescens*), and Solitary Vireo (*Vireo solitarius*).

An exotic insect, the Balsam Woolly Adelgid (*Adelges piceae*), invaded the southern Appalachians in the late 1950's and has drastically altered the last undisturbed remnants of this community. This exotic pest kills mature *Abies fraseri* within seven years of infestation.

CONSERVATION RANK G2

RANK JUSTIFICATION
This community is restricted to the highest mountain systems of the southern Appalachians in eastern Tennessee, western North Carolina, and southwestern Virginia. It has a naturally restricted distribution and has been subject to major acreage reduction during the early part of the 20th century and rapid condition decline in the past 30 years. Modern threats include atmospheric pollution deposition and damage by *Adelges piceae*, the exotic Balsam Woolly Adelgid. Well-developed, undisturbed examples of this community are extremely rare.

DATABASE CODE CEGL007131

COMMENTS
***Globally***
A similar forest, *Picea rubens - Abies fraseri / (Rhododendron catawbiense - Rhododendron maximum*) Forest (CEGL007130), has a shrub stratum dominated by evergreen species and occurs on less mesic sites than the one described here. Similar forests occur in the central and northern Appalachians but have *Abies balsamea* as the fir component and less dense herb and bryophyte cover (Oosting and Billings 1951; Whittaker 1956; Crandell 1958). As a result of human disturbance, primarily large-scale corporate logging (1880-1930), sometimes followed by fire and massive soil erosion, present day *Picea rubens* and *Abies fraseri* vegetation in the southern Appalachians is estimated to cover only 48 percent (69 square kilometers) of the presettlement area (Cogbill and White 1991).

***Great Smoky Mountains National Park***
Examples of this community observed on the Mount Le Conte quadrangle were formerly codominated by *Picea rubens* and *Abies fraseri.* On the Mount Le Conte quadrangle, this forest grades into lower elevation forests dominated by *Picea rubens* and/or *Betula alleghaniensis* or forests dominated by *Picea rubens, Tsuga canadensis*, and *Betula alleghaniensis.* Some occurrences of this community may be floristically similar to *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata* Forest (CEGL006256).

REFERENCES
Brown 1941, Bruck 1988, Busing et al. 1988, Cogbill and White 1991, Crandall 1958, Crandall 1960, Davis 1930, Dull et al. 1988, Golden 1974, Korstian 1937, McLeod 1988, Nicholas et al. 1992, North Carolina Natural Heritage Program 1993, Oosting and Billings 1951,Ramseur 1960, Rawinski 1992, Schafale and Weakley 1990, Schofield 1960, Stephenson and Adams 1984, Stephenson and Clovis 1983, Wentworth et al. 1988, White 1984, White and Cogbill 1992, White and Pickett 1985, White et al. 1993, Whittaker 1956, Zedaker et al. 1988